BMJ open

Factors associated with anxiety and depression among type 2 diabetic outpatients in Malaysia: A descriptive single-center study

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2014-004794
Article Type:	Research
Date Submitted by the Author:	03-Jan-2014
Complete List of Authors:	Ganasegeran, Kurubaran; Management and Science University (MSU), International Medical School Renganathan, Pukunan; Tengku Ampuan Rahimah Hospital (HTAR), Clinical Research Center Manaf, Rizal; Universiti Kebangsaan Malaysia (UKM), Community Health Department, Faculty of Medicine Al-Dubai, Sami; International Medical University (IMU), Department of Community Medicine
Primary Subject Heading:	Diabetes and endocrinology
Secondary Subject Heading:	General practice / Family practice
Keywords:	General diabetes < DIABETES & ENDOCRINOLOGY, Anxiety disorders < PSYCHIATRY, Depression & mood disorders < PSYCHIATRY

Factors associated with anxiety and depression among type 2 diabetic outpatients in Malaysia: A descriptive single-center study

Kurubaran Ganasegeran[1*], Pukunan Renganathan[2], Rizal Abdul Manaf[3], Sami Abdo Radman Al-Dubai[4]

[1] International Medical School, Management and Science University (MSU), Shah Alam, Selangor, Malaysia.

[2] Clinical Research Center, Tengku Ampuan Rahimah Hospital (HTAR), Klang, Selangor, Malaysia.

[3] Community Health Department, Faculty of Medicine, Universiti Kebangsaan Malaysia (UKM), Kuala Lumpur, Malaysia.

[4] Department of Community Medicine, International Medical University (IMU), Kuala Lumpur, Malaysia.

*** Corresponding author:**

Dr. Kurubaran Ganasegeran, BMedSc (Hons), MBBS
International Medical School, Management and Science University (MSU), University Drive, Off Persiaran Olahraga, Section 13, 40100, Shah Alam, Selangor, Malaysia
Email: medkuru@yahoo.com
Tel: +603-0193711268

ABSTRACT

Objective: To determine the factors associated with anxiety and depression among diabetic outpatients in Malaysia.

Design: Descriptive, cross-sectional study – mixed methods (survey and retrospective patient data) with universal sampling of all diabetic subjects.

Setting: Endocrinology Clinic of Medical Outpatient Department (MOPD) in a Malaysian public hospital.

Participants: All 169 type 2 diabetic subjects (Males, n=99; Females, n=70) aged between 13-90 years old that acquired follow-up treatment from the Endocrinology Clinic in the month of September 2013.

Main outcome measures: The validated Hospital Anxiety and Depression Scale (HADS), socio-demographic characteristics and clinical health information from patient records.

Results: Of the total 169 diabetics surveyed, anxiety and depression were found in 53 (31.4%) and 68 (40.3%) of the subjects respectively. In multivariate analysis, age, ethnicity and ischemic heart disease (IHD) were predictors of anxiety, while age, ethnicity and monthly household income were predictors of depression.

Conclusion: Socio-demographics and clinical health factors were important correlates of anxiety and depression among diabetics. Integrated psychological and medical care to boost self-determination and confidence in the management of diabetes would catalyze optimal health outcomes among diabetic subjects.

Strengths and limitations of this study

- Malaysia suffers the highest rate of diabetics in the Asian region. Diabetics are twice more likely to develop anxiety and depression, causing poor health outcomes and increased mortality.
- This study aimed to assess the factors associated with anxiety and depression among diabetic outpatients in Malaysia.
- Integrated psychological and medical care to boost self-determination and confidence in the management of diabetes would catalyze optimal health outcomes among diabetic subjects.
- The absence of a control group and a relatively small sample size from one hospital might limit the generalizability of the study findings. The cross-sectional design of the study limits our ability to make causal inferences.

INTRODUCTION

Type 2 diabetes is a chronic metabolic disorder characterized by hyperglycemia due to insulin deficiency.[1] The global prevalence of diabetes is currently estimated to be 285 million and projection rates are expected to rise to over 438 million by the year 2030,[2] with Asia suffering the bulk of the total diabetic epidemic.[3] The Malaysian scenario is more debilitating when figures confirmed that the country suffers the highest rate of diabetics in the Asian region, with prevalence rates rising from 14.9% in 2006 to 20.8% in 2011.[4]

The complex mechanism to cope with chronic diseases requires self-determination to overcome the emotional shock of the diagnoses and proper assimilation of information regarding self-care to prevent disease complications.[5] The collapse of these coping strategies over time due to low psychological, emotional, and social support renders significant co-morbid anxiety and depression, exacerbating disease complications and poor prognosis.[5] Diabetics were twice at risks to suffer from pre-morbid anxiety and depression as the general population.[2,6] The co-existence of anxiety and depression in diabetic subjects catalyzes serious disease co-morbidities, complications, poor quality of life and escalated health care expenditures.[7]

Anxious and depressed diabetic subjects are less likely to comply with diabetes self-care recommendations.[6] The diagnosis of diabetes is a life threatening stressor that demands high mental and physical accommodations due to elevated feelings of fear.[8] Depression among diabetics adds an increased burden to patient adherence, compliance and poor prognosis for quality health outcomes.[9] Depression in diabetic population has been associated with potential socio-demographic and clinical factors.[7] Ageing,[2] ethnicity,[8] socio-economic status,[10] education level,[11] and unemployment[12] were important correlates for diabetic depression.

Common diabetic vascular complications like ischemic heart disease (IHD), cerebrovascular accidents (CVA) and diabetic nephropathy had caused significant rates of mortality and poor quality of life.[2,11] Malaysia topped the world in diabetic nephropathy, with almost 15,000 subjects requiring dialysis and 2000 acquiring kidney transplants.[13] Diabetic related complications and associated co-morbidities have been proven to amplify psychiatric conditions.[2]

Numerous studies from developed and developing countries assessed factors affecting anxiety and depression among diabetic subjects.[2,6,14] Irish and Mexican studies concluded that the prevalence of anxiety and depression was considerably higher among diabetic subjects in comparison to the general population.[6,9] A Malaysian study recommended that early psychiatric screening was required owing to elevated risks for anxiety and depression among diabetic subjects.[8] This study aimed to determine the factors associated with anxiety and depression among diabetic outpatients in a Malaysian public hospital.

METHODS

Study Setting and Population

This cross-sectional single-center study was conducted in the month of September 2013 among all 169 type 2 diabetic subjects aged between 13 to 90 years who acquired follow-up treatment from the Endocrinology Clinic at the Medical Outpatient Department (MOPD) of Tengku Ampuan Rahimah Hospital, Selangor, Malaysia. Objectives and benefits of the study were explained in verbal and written form attached to the questionnaires. Subjects were assured that their participation was confidential and would not affect their medical treatment outcomes. A written consent was obtained from those who agreed to participate. Subjects with type 1 diabetes and gestational diabetes were excluded from the study.

Ethical Issues

This study complied with the guidelines convened in the Declaration of Helsinki. The study was conducted as part of a larger study that explored anxiety and depression among outpatients in Malaysia. Study protocol was approved by the Medical Research Ethics Committee (MREC), Ministry of Health Malaysia (NMRR-13-643-14711).

Study Instruments

A self-administered questionnaire consisting of three parts was used in this study:

The first part included items on socio-demographics (gender, age, ethnicity, marital status, education level, residence, monthly household income, and employment status).

The second part assessed anxiety and depression among diabetic subjects. Anxiety is defined as subjective experience of fear and its' physical manifestations while depression is defined as anhedonia (reduced positive affect).[15] To explore anxiety and depression among diabetic subjects, we used the Hospital Anxiety and Depression Scale (HADS), originally developed by Zigmond and Snaith,[16] and validated among Malaysian population.[17] This widely used self-assessment tool screens emotional distress (anxiety and depression) in various clinical settings, including diabetic population.[2,6,18] HADS is comprised of fourteen items, seven of which measures anxiety (HADS-A) and another seven measures depression (HADS-D). These items are scored on a four-point Likert scale ranging from zero (not present) to three (considerable). Item scores were summed to provide sub-scaled scores of anxiety and depression, ranged between 0-21, and total summed score ranged from 0-42. A higher score represents higher anxiety or depression.[18] The scores are categorized as follows: Normal (0-7) and caseness which

includes mild distress (8-10), moderate distress (11-14) and severe distress (15-21).[18] The questionnaire was administered in English.

The third part included clinical health information of the subjects derived from medical records:

Baseline Data Definitions

Type 2 Diabetes

The presence of diabetes diagnosed by a physician with a fasting plasma glucose value of 7.0 mmol/l (126 mg/dl) or higher,[19] and subjects currently being administered with oral hypoglycemic drugs or insulin therapy as documented in medical records were included in this study.

Diabetes Vascular Complications

Vascular complications in diabetes were considered when subjects were diagnosed with cerebrovascular accident (CVA), ischemic heart disease (IHD) or nephropathies. Subjects diagnosed with either one vascular complication over the past year were included in this study. Cerebrovascular accident (CVA) was defined as hemiparesis cases proven by medical and CT scan records.[20] Ischemic heart disease (IHD) was considered to exist with a history of angina or acute coronary syndromes (ACS) elicited among diabetic subjects and documented in medical records.[2] Nephropathy is defined by proteinuria > 500 mg in 24 hours among diabetic cases from medical records.[1]

Diabetes Co-morbid Conditions

Diabetic subjects were classified as hypertensive if they were previously diagnosed and were currently on anti-hypertensive medications[2] as documented in medical records. Dyslipidemia was defined as high plasma triglyceride concentration, low HDL cholesterol concentration and

increased concentration of LDL-cholesterol[21] with study subjects currently on statin medications as documented in medical records.

Statistical analysis

Analysis was performed using Statistical Package of Social Sciences (SPSS®) (version 16.0, IBM, Armonk, NY). Descriptive analysis was performed for all variables in this study. To check for the validity of the Hospital Anxiety and Depression Scale (HADS) among Malaysian subjects, an exploratory factor analysis was performed using principal component method with varimax rotation and Cronbach's alpha was used to test the internal consistency of the scale. Anxiety and depression scores were expressed as mean and standard deviations. Test of normality was performed for total anxiety and depression sub-scale scores. T-test and ANOVA test were applied to compare anxiety and depression across socio-demographic and clinical health variables. In case of ANOVA, post hoc test was used to determine where the significant difference was. Multiple linear regression analysis using "Enter" technique was employed to obtain significant factors associated with anxiety and depression among diabetic subjects. The accepted level of significance was set below 0.05 ($p<0.05$). Multicollinearity was checked between independent variables.

RESULTS

Socio-demographic characteristics of the respondents

One hundred sixty nine subjects were included in this study. Of the total, 99 (58.6%) were males and 70 (41.4%) were females. The mean (±SD) age of the subjects was 36.9 (±15.9) years and the majority aged less than 30 years old 137 (81.1%). The majority of the subjects were Chinese 88 (52.1%), married 106 (62.7%) and residing in an urban area 132 (78.1%). Most subjects were

tertiary educated 94 (55.6%) and currently being employed 119 (70.4%) with a monthly household income of MYR3000 or more 113 (66.9%) (Table 1).

Clinical health information of the respondents

Baseline clinical data of the subjects are summarized in Table (2). Of the total subjects, fifty three (31.4%) were diagnosed for diabetic macrovascular complications. Twelve subjects (7.1%) were diagnosed for cerebrovascular accident (CVA), 24 (14.2%) were diagnosed for ischemic heart disease (IHD) and 17 (10.1%) developed nephropathy. Forty four (26.0%) subjects developed at least one co-morbid condition while 21 (12.4%) had two co-morbid conditions. Cronbach's alpha coefficient for HADS-A subscale was 0.83 while Cronbach's alpha coefficient for HADS-D subscale was 0.71. Mild anxiety and depression were found in 33 (19.5%) and 49 (29.0%) of the subjects respectively. Moderate anxiety and depression were found in 16 (9.5%) subjects respectively. Severe anxiety and depressive symptoms were detected in 4 (2.4%) and 3 (1.8%) of the subjects respectively.

Association between anxiety and depression with socio-demographics of the respondents

Table (3) shows the association between anxiety and depression with socio-demographic characteristics. Subjects aged 50 years or older had higher anxiety score (9.1 ± 4.6) compared to those aged less than 50 years old (6.4 ± 2.7; $p<0.001$). Significant associations were observed between anxiety and ethnicity ($p<0.001$), a post hoc tests showed that Indians exhibited higher anxiety score (8.4 ± 4.2) in comparison to Chinese (6.6 ± 2.4, $p=0.044$). Subjects graduated from high school exhibited higher anxiety score (7.5 ± 4.0) in comparison to those with a tertiary degree (6.4 ± 2.5; $p=0.037$). In addition, subjects aged 50 years or older were more depressed (9.2 ± 4.0) in comparison to those aged less than 50 years old (6.3 ± 2.9; $p<0.001$). Significant

associations were observed between depression and ethnicity (p<0.001), post hoc tests revealed that Indians exhibited higher depression (9.8 ± 3.5) in comparison to Malays (6.9 ± 3.1) and Chinese (5.9 ± 2.9; p<0.001 respectively). Similarly, subjects graduated from high school exhibited greater depression (7.7 ± 3.7) in comparison to tertiary graduates (6.2 ± 2.9; p=0.006). Subjects with a monthly household income of less than MYR3000 have higher depression score (8.7 ± 3.6) compared to those with higher income (6.0 ± 2.8; p<0.001). Similarly, unemployed subjects portrayed higher depression score (7.9 ± 3.2) in comparison to those being employed (6.4 ± 3.3, p=0.007).

Association between anxiety and depression with clinical health information of the respondents

Subjects diagnosed for ischemic heart disease (IHD) exhibited higher anxiety score (8.7 ± 4.2) in comparison to those without such complication (6.6 ± 3.1; p=0.004). In addition, significant associations were observed between depression and disease co-morbidities (p=0.010), a post hoc tests showed that diabetic subjects with associated hypertension or dyslipidemia had higher depression score (7.5 ± 3.2) in comparison to subjects without co-morbid conditions (6.3 ± 3.4, p=0.009) (Table 4).

Predictors of anxiety among diabetics by multiple linear regression

Table (5) exhibits predictors of anxiety among diabetics. Subjects aged ≥50 years had on the average 2.3 (95% CI 0.9-3.6) higher anxiety score in comparison to those aged less than 50 years old (p=0.001). Indians had on the average 1.7 (95% CI 0.3-3.2) higher anxiety score compared to Malays (p=0.018). Subjects diagnosed with ischemic heart disease (IHD) had on the average 1.5 (95% CI 0.1-2.9) higher anxiety score in comparison to those without such condition (p=0.039).

Predictors of depression among diabetics by multiple linear regression

Table (6) shows predictors of depression among diabetics. Subjects aged ≥50 years had on the average 1.4 (95% CI 0.2-2.7) higher depression score in comparison to those aged less than 50 years old (p=0.027). Indians had on the average 2.7 (95% CI 1.4-4.0) higher depression score compared to Chinese (p<0.001). Subjects with a monthly household income of less than MYR3000 had on the average 1.9 (95% CI 0.8-3.0) higher depression score compared to those with a higher income (p=0.001).

DISCUSSION

This study aimed to determine the factors associated with anxiety and depression among diabetic outpatients in Malaysia. Of the 169 diabetic subjects surveyed, 31.4% perceived anxious states while 40.3% exhibited depressive symptoms. The estimated rate of anxiety reported in this study was similar to an Irish sample (32.0%),[6] but relatively lower to that found in Mexican (52.9%)[9] and Pakistani (57.9%) subjects.[2] In contrary, self-reported depression rates reported in this study were similar to that found in Mexican (47.7%)[9] and Pakistani (43.5%) samples,[2] but comparatively higher to that found in Irish subjects (22.4%).[6] In the final model, age, ethnicity and diagnosis of ischemic heart disease were significantly associated with anxiety, while factors that significantly contributed to depression among diabetics were age, ethnicity and monthly household income.

Ageing appears to accelerate diabetic vascular complications and hyperglycemic crisis, causing poor functional status and high mortality rates.[22] Dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis and over-activation of the sympathetic nervous system due to fear of hypoglycemia, complications or mortality are immediate physiological processes that prompts

higher anxiety states among older population.[5] This study found a significantly higher anxious state among older diabetic subjects compared to younger ones. Collins et al.[6] reported otherwise.

The development of vascular complications is a predictive factor for psychological morbidity among diabetic subjects.[23] This study found a significantly higher anxiety level among subjects with ischemic heart disease. Khuwaja et al.[2] reported similar associations.

The increased susceptibility to various diseases, disabilities and social isolation among older population causes serious psychological repercussions.[24] This study found a significantly higher depression score among older subjects in comparison to younger ones. Similar findings were found among diabetic subjects in other countries. [2,25]

Latest statistics revealed by the Ministry of Health Malaysia reported that the prevalence of diabetes was the highest among Indian ethnic (24.9%), followed by Malay ethnic (17.0%) and Chinese ethnic (13.9%).[4] Minority ethnic groups have been known to experience higher anxiety and depression rates.[26,27] This study found a significantly higher anxiety and depression level among Indian subjects in comparison to other ethnicities. A recent Malaysian study which reported similar associations postulated that minority ethnic Indians experienced extensive psychological co-morbidities due to triadic stressors of socio-economic constraints, poor education level and perceived discrimination.[8]

Higher depression states in unemployment is caused by reduced sociological functions such as status identity, social contacts, participation in collective purposes and regular activities.[12] This study found a significantly higher depression status among unemployed subjects in comparison to those being employed. Kaur et al.[8] reported similar consistencies. In addition, this study found a significantly higher depression level in lower income diabetic subjects. Similar findings were reported in a Malaysian study.[8] Reduced confidence due to economic instability

and increased healthcare expenditures for routine diabetic screening complications, co-morbid conditions and adherence to treatment pose substantial psychological illness among diabetic subjects.[9]

Diabetes co-morbid conditions like hypertension and dyslipidemia has been known to amplify disease complications and poor treatment outcomes.[21,28] Increased rates of depression have been found in diabetic subjects with hypertension.[28] An exponential rise of mortality rates due serious cardiovascular disease complications in dyslipidemia would contribute to high depression rates among diabetic subjects due reduced quality of life and poor prognosis.[7,21] This study found a significantly higher depression score among diabetic subjects with hypertension or dyslipidemia. Khuwaja et al.[2] found similar findings.

Higher education attainment has been linked to be a protective factor against anxiety and depression among diabetic subjects.[6,11,29] Education drives individuals towards proper understanding of disease mechanisms and complications, prompting increased compliance and adherence towards disease treatment for better health outcomes. Our study found a significantly lower anxiety and depression level among tertiary educated subjects in comparison to high school graduates. Similar findings were found in other studies.[6,11,29]

LIMITATIONS

The major limitations of this study were the absence of a control group and a small sample size from one hospital. These might limit the generalizability of the study findings. The cross-sectional design of the study limits our ability to make causal inferences. Further research is needed to address these limitations.

CONCLUSION

Socio-demographics and clinical factors were important correlates of anxiety and depression. This study found that age, ethnicity and ischemic heart disease (IHD) were predictors of anxiety. Predictors of depression among diabetic subjects were age, ethnicity, and monthly household income.

RECOMMENDATIONS

Early recognition of vulnerable factors associated with anxiety and depression in diabetic subjects are necessary to promote patient adherence and compliance to diabetic control. Collaborative teamwork between healthcare providers and patients through compassionate holistic approach in recognizing early neurotic features is essential to prevent disease co-morbidities and mortalities. Rejuvenating primary health care policies from an essentially *'reactive based system'* (responding only when individuals are sick) to a *'proactive based system'* (focus on overall mental and physical health well-being) needs to be drafted immediately and amalgamated in all public health facilities within Malaysia. Increasing patient awareness to boost self-determination and confidence through integrated psychological and medical care in the management of diabetes would catalyze optimal health outcomes, as mused Osler (1961) in his epitaph;

"Care more for the individual patient than for the special features of the disease...Put yourself in his place... The kindly word, the cheerful greeting, the sympathetic look - these the patient understands."

Sir William Osler (Aphorisms from his bedside teachings and writings, 1961)

Contributors: KG had the original idea, designed the study, drafted the first version of the manuscript and is responsible for the final version. PR and RAM assisted with the study design, data collection, the literature research and editing of the manuscript. KG and SARA contributed to the study coordination, data analysis and preparation of the manuscript. SARA revised the final draft critically for important intellectual content. All authors have contributed to and approved the final manuscript.

Funding statement: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests: None declared.

REFERENCES:

1. Fowler *MJ.* Microvascular and macrovascular complications of diabetes. *Clinical Diabetes* 2008; 26: 77-82.

2. Khuwaja AK, Lalani S, Dhanani R, *et al.* Anxiety and depression among outpatients with type 2 diabetes: a multi-centre study of prevalence and associated factors. *Diabetology & Metabolic Syndrome* 2010; 2: 72.

3. International Diabetes Federation. *Diabetes Atlas* 2010; 4. http://www.worlddiabetesfoundation.org/composite-35.htm

4. Statistics Malaysia-health facts. *Ministry of Health Malaysia* 2013. www.moh.gov.my

5. Gonzalez JS, Sabrina A, Havah E, *et al.* Psychological issues in adults with type 2 diabetes - psychological co-morbidities of physical illness: a behavioral medicine perspective. *Springer Science Business Media LLC* 2011; 2: 73-121.

6. Collins MM, Corcoran P, Perry IJ. Anxiety and depression symptoms in patients with diabetes. *Diabetic Medicine* 2009; 26: 153–161.

7. Engum A, Mykletun A, Midthjell K, *et al.* Depression and diabetes - a large population-based study of sociodemographic, lifestyle, and clinical factors associated with depression in type 1 and type 2 diabetes. *Diabetes Care* 2005; 28: 1904–9.

8. Kaur G, Tee GH, Ariaratnam S, *et al.* Depression, anxiety and stress symptoms among diabetics in Malaysia: a cross sectional study in an urban primary care setting. *BMC Family Practice* 2013; 14: 69.

9. Tovilla-Zarate C, Juarez-Rojop I, Jimenez YP, *et al.* Prevalence of anxiety and depression among outpatients with Type 2 diabetes in the Mexican population. *Plos One* 2012: 7: e36887.

10. Everson SA, Maty SC, Lynch JW, *et al.* Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. *J Psychosom Res* 2002; 53:891– 95.

11. Peyrot M, Rubin R. Levels and risks of depression and anxiety symptomatology among diabetic adults. *Diabetes Care* 1997; 20: 585–90.

12. Palizgir M, Bakhtiari M, Esteghamati A. Association of depression and anxiety with diabetes mellitus type 2 concerning some sociological factors. *Iranian Red Crescent Medical Journal* 2013; 15: 644-48.

13. National Renal Registry Malaysia. *Clinical Research Center Ministry of Health Malaysia* 2006. www.crc.gov.my

14. Katon W, Unutzer J, Russo J. Major depression: the importance of clinical characteristics and treatment response to prognosis. *Depression and Anxiety* 2010; 27:19–26.

15. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) 2000; 4.

16. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983; 67: 361–70.

17. Fatt QK, Atiya AS, Heng NGC, *et al.* Validation of the Hospital Anxiety and Depression Scale and the psychological disorder among premature ejaculation subjects. *International Journal of Impotence Research* 2007; 19: 321–25.

18. Whelan-Goodinson R, Ponsford J. Validity of the Hospital Anxiety and Depression Scale to assess depression and anxiety following traumatic brain injury as compared with the Structured Clinical Interview for DSM-IV. *Journal of Affective Disorders* 2009; 114: 94-102.

19. American Diabetes Association. Standards of medical care in diabetes. *Diabetes Care* 2006; 29:4–42.

20. Vaz NC, Ferreira AM, Kulkarni MS, et al. Prevalence of diabetic complications in rural Goa, India. *Indian J Community Med* 2011; 36: 283–6.

21. Mooradian AD. Dyslipidemia in type 2 diabetes mellitus. *Nature Clinical Practice: Endocrinology & Metabolism* 2009; 5: 150-9.

22. Morley JE. The elderly type 2 diabetic patient: special considerations. Diabetic Medicine 1998; 15: 41-6.

23. Almawi W, Tamim H, Al-Sayed N, *et al.* Association of comorbid depression, anxiety, and stress disorders with Type 2 diabetes in Bahrain, a country with a very high prevalence of type 2 diabetes. *Journal of Endocrinological Investigation* 2008; 31: 1020–24.

24. Ganatra HA, Zafar SN, Qidwai W, *et al.* Prevalence and predictors of depression among an elderly population of Pakistan. *Aging Ment Health* 2008; 12:349-56.

25. Mosaku K, Kolawole B, Mume C, *et al.* Depression, anxiety and quality of life among diabetic patients: a comparative study. *Journal of the National Medical Association* 2008; 100: 73–8.

26. Dunlop DD, Song J, Lyons JS, *et al.* Racial or ethnic differences in rates of depression among preretirement adults. *Am J Public Health* 2003; 93:1945–952.

27. Fisher L, Laurencin G, Chesla CA, *et al.* Depressive affect among four ethnic groups of male patients with type 2 diabetes. *Diabetes Spectr* 2004; 17:215–19.

28. Thomas J, Jones G, Scarinci I, *et al.* A descriptive and comparative study of the prevalence of depressive and anxiety disorders in low-income adults with type 2 diabetes and other chronic illnesses. *Diabetes Care* 2003; 26:2311–17.

29. Bener A, Al-Hamaq AO, Dafeeah EE. High prevalence of depression, anxiety and stress symptoms among diabetes mellitus patients. *The Open Psychiatry Journal* 2011; 5: 5-12.

Table 1: Socio-demographic characteristics of the respondents (n=169)

Characteristics	N	Percentage (%)
Gender		
Male	99	58.6
Female	70	41.4
Age (years)		
< 50	137	81.1
≥ 50	32	18.9
Ethnicity		
Malay	53	31.3
Chinese	88	52.1
Indian	28	16.6
Marital status		
Single	63	37.3
Married	106	62.7
Highest education level		
High school	75	44.4
Tertiary education	94	55.6
Residence		
Urban	132	78.1
Rural	37	21.9
Monthly household income (MYR)		
< 3000	56	33.1
≥ 3000	113	66.9
Current employment status		
Employed	119	70.4
Unemployed	50	29.6

Table 2: Clinical health information of the respondents (n=169)

Characteristics	N	Percentage (%)
Diabetes vascular complications		
Cerebrovascular accident (CVA)		
Yes	12	7.1
No	157	92.9
Ischemic heart disease (IHD)		
Yes	24	14.2
No	145	85.8
Diabetic nephropathy		
Yes	17	10.1
No	152	89.9
Co-morbidities		
Diabetes alone	104	61.6
Diabetes with hypertension or dyslipidemia	44	26.0
Diabetes with hypertension and dyslipidemia	21	12.4
Anxiety		
Normal	116	68.6
Mild	33	19.5
Moderate	16	9.5
Severe	4	2.4
Depression		
Normal	101	59.7
Mild	49	29.0
Moderate	16	9.5
Severe	3	1.8

Table 3: Association between anxiety and depression with socio-demographic characteristics of the respondents (n=169)

Characteristics	Anxiety		Depression	
	Mean (SD)	P-value	Mean (SD)	P-value
Gender				
Male	7.0 (3.5)		7.1 (3.5)	
Female	6.8 (3.0)	0.737	6.6 (3.1)	0.345
Age (years)				
< 50	6.4 (2.7)		6.3 (2.9)	
≥ 50	9.1 (4.6)	< 0.001	9.2 (4.0)	<0.001
Ethnicity				
Malay	6.5 (3.8)		6.9 (3.1)	
Chinese	6.6 (2.4)		5.9 (2.9)	
Indian	8.4 (4.2)	0.035	9.8 (3.5)	< 0.001
Marital status				
Single	6.7 (2.7)		6.9 (2.9)	
Married	7.0 (3.6)	0.601	6.8 (3.6)	0.894
Highest education level				
High school	7.5 (4.0)		7.7 (3.7)	
Tertiary education	6.4 (2.5)	0.037	6.2 (2.9)	0.006
Residence				
Urban	6.8 (2.9)		6.7 (3.1)	
Rural	7.2 (4.5)	0.569	7.6 (3.9)	0.125
Monthly household income (MYR)				
< 3000	7.5 (4.4)		8.7 (3.6)	
≥ 3000	6.6 (2.6)	0.090	6.0 (2.8)	<0.001
Current employment status				
Employed	6.6 (3.2)		6.4 (3.3)	
Unemployed	7.6 (3.4)	0.078	7.9 (3.2)	0.007

Table 4: Association between anxiety and depression with clinical health information of the respondents (n=169)

Characteristics	Anxiety		Depression	
	Mean (SD)	P-value	Mean (SD)	P-value
Diabetes vascular complications				
Cerebrovascular accident (CVA)				
Yes	6.6 (4.1)		6.7 (4.8)	
No	6.9 (3.3)	0.742	6.9 (3.2)	0.823
Ischemic heart disease (IHD)				
Yes	8.7 (4.2)		7.8 (4.1)	
No	6.6 (3.1)	0.004	6.7 (3.2)	0.131
Diabetic nephropathy				
Yes	7.4 (2.2)		6.4 (3.0)	
No	6.8 (3.4)	0.492	6.9 (3.4)	0.548
Co-morbidities				
Diabetes alone	6.6 (3.3)		6.3 (3.4)	
Diabetes with hypertension or dyslipidemia	7.2 (3.4)		7.5 (3.2)	
Diabetes with hypertension and dyslipidemia	7.7 (3.0)	0.289	8.4 (2.9)	0.010

Table 5: Predictors of anxiety among diabetics by multiple linear regression (n=169)

Predictors	B	SE	Beta	P-value	95% CI	
					Lower	Upper
Age (Years)						
< 50	Ref	Ref	Ref	Ref	Ref	Ref
≥ 50	2.3	0.7	0.3	0.001	0.9	3.6
Ethnicity						
Malay	Ref	Ref	Ref	Ref	Ref	Ref
Chinese	0.7	0.6	0.1	0.194	-0.4	1.8
Indian	1.7	0.7	0.2	0.018	0.3	3.2
Highest education level						
High school	0.1	0.5	0.0	0.871	-1.0	1.1
Tertiary educated	Ref	Ref	Ref	Ref	Ref	Ref
Having ischemic heart disease (IHD)						
Yes	1.5	0.7	0.2	0.039	0.1	2.9
No	Ref	Ref	Ref	Ref	Ref	Ref

Table 6: Predictors of depression among diabetics by multiple linear regression (n=169)

Predictors	B	SE	Beta	P-value	95% CI	
					Lower	Upper
Age (Years)						
< 50	Ref	Ref	Ref	Ref	Ref	Ref
≥ 50	1.4	0.6	0.2	0.027	0.2	2.7
Ethnicity						
Malay	0.4	0.5	0.1	0.458	-0.7	1.4
Indian	2.7	0.7	0.3	<0.001	1.4	4.0
Chinese	Ref	Ref	Ref	Ref	Ref	Ref
Highest education level						
High school	-0.3	0.5	-0.1	0.548	-1.4	0.7
Tertiary educated	Ref	Ref	Ref	Ref	Ref	Ref
Monthly household income (MYR)						
< 3000	1.9	0.6	0.3	0.001	0.8	3.0
≥ 3000	Ref	Ref	Ref	Ref	Ref	Ref
Current employment status						
Employed	Ref	Ref	Ref	Ref	Ref	Ref
Unemployed	-1.7	1.5	-0.2	0.265	-4.7	1.3
Co-morbidities						
Diabetes alone	Ref	Ref	Ref	Ref	Ref	Ref
Diabetes with hypertension or dyslipidemia	-2.6	1.5	-0.4	0.080	-5.5	0.3
Diabetes with hypertension and dyslipidemia	-2.3	1.7	-0.2	0.189	-5.7	1.1

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6,7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6,7
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	8
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	-
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	8
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	-
Outcome data	15*	Report numbers of outcome events or summary measures	8,9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-11
		(*b*) Report category boundaries when continuous variables were categorized	9-11
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Factors associated with anxiety and depression among type 2 diabetes outpatients in Malaysia: a descriptive cross-sectional single-centre study.

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2014-004794.R1
Article Type:	Research
Date Submitted by the Author:	03-Apr-2014
Complete List of Authors:	Ganasegeran, Kurubaran; Management and Science University (MSU), International Medical School Renganathan, Pukunan; Tengku Ampuan Rahimah Hospital (HTAR), Clinical Research Center Manaf, Rizal; Universiti Kebangsaan Malaysia (UKM), Community Health Department, Faculty of Medicine Al-Dubai, Sami; International Medical University (IMU), Department of Community Medicine
Primary Subject Heading:	Diabetes and endocrinology
Secondary Subject Heading:	General practice / Family practice
Keywords:	General diabetes < DIABETES & ENDOCRINOLOGY, Anxiety disorders < PSYCHIATRY, Depression & mood disorders < PSYCHIATRY

Factors associated with anxiety and depression among type 2 diabetes outpatients in Malaysia: a descriptive cross-sectional single-center study

Kurubaran Ganasegeran[1*], Pukunan Renganathan[2], Rizal Abdul Manaf[3], Sami Abdo Radman Al-Dubai[4]

[1] International Medical School, Management and Science University (MSU), Shah Alam, Selangor, Malaysia.

[2] Clinical Research Center, Tengku Ampuan Rahimah Hospital (HTAR), Klang, Selangor, Malaysia.

[3] Community Health Department, Faculty of Medicine, Universiti Kebangsaan Malaysia (UKM), Kuala Lumpur, Malaysia.

[4] Department of Community Medicine, International Medical University (IMU), Kuala Lumpur, Malaysia.

*** Corresponding author:**

Dr. Kurubaran Ganasegeran, BMedSc (Hons), MBBS
International Medical School, Management and Science University (MSU), University Drive, Off Persiaran Olahraga, Section 13, 40100, Shah Alam, Selangor, Malaysia
Email: medkuru@yahoo.com
Tel: +60193711268

ABSTRACT

Objective: To determine the prevalence and factors associated with anxiety and depression among type 2 diabetes outpatients in Malaysia.

Design: Descriptive, cross-sectional single-center study with universal sampling of all patients with type 2 diabetes.

Setting: Endocrinology Clinic of Medical Outpatient Department (MOPD) in a Malaysian public hospital.

Participants: All 169 patients with type 2 diabetes (Males, n=99; Females, n=70) aged between 18-90 years who acquired follow-up treatment from the Endocrinology Clinic in the month of September 2013.

Main outcome measures: The validated Hospital Anxiety and Depression Scale (HADS), socio-demographic characteristics and clinical health information from patient records.

Results: Of the total 169 patients surveyed, anxiety and depression were found in 53 (31.4%) and 68 (40.3%) respectively. In multivariate analysis, age, ethnicity and ischemic heart disease (IHD) were significantly associated with anxiety, while age, ethnicity and monthly household income were significantly associated with depression.

Conclusion: Socio-demographics and clinical health factors were important correlates of anxiety and depression among patients with diabetes. Integrated psychological and medical care to boost self-determination and confidence in the management of diabetes would catalyze optimal health outcomes among patients with diabetes.

Strengths and limitations of this study

- Malaysia suffers the highest rate of diabetes in the Asian region. People with diabetes are twice more likely to develop anxiety and depression, causing poor health outcomes and increased mortality.
- This study aimed to assess the prevalence and factors associated with anxiety and depression among type 2 diabetes outpatients in Malaysia.
- Integrated psychological and medical care to boost self-determination and confidence in the management of diabetes would catalyze optimal health outcomes among patients with diabetes. .
- The absence of a control group and a relatively small sample size from one hospital might limit the generalizability of the study findings. The cross-sectional design of the study limits our ability to make causal inferences.

INTRODUCTION

Type 2 diabetes is a chronic metabolic disorder characterized by hyperglycemia due to insulin deficiency.[1] The global prevalence of diabetes is currently estimated to be 285 million and projection rates are expected to rise to over 438 million by the year 2030,[2] with Asia suffering the bulk of the total diabetes epidemic.[3] The Malaysian scenario is more debilitating when figures confirmed that the country suffers the highest rate of diabetes in the Asian region, with prevalence rates rising from 14.9% in 2006 to 20.8% in 2011.[4]

The complex mechanism to cope with chronic diseases requires self-determination to overcome the emotional shock of the diagnoses and proper assimilation of information regarding self-care to prevent disease complications.[5] The collapse of these coping strategies over time due to low psychological, emotional, and social support renders significant co-morbid anxiety and depression, exacerbating disease complications and poor prognosis.[5] People with diabetes were twice at risks to suffer from pre-morbid anxiety and depression as the general population.[2,6] The co-existence of anxiety and depression in people with diabetes catalyzes serious disease co-morbidities, complications, poor quality of life and escalated health care expenditures.[7]

Anxious and depressed people with diabetes are less likely to comply with diabetes self-care recommendations.[6] The diagnosis of diabetes is a life threatening stressor that demands high mental and physical accommodations due to elevated feelings of fear.[8] Depression among people with diabetes adds an increased burden to patient adherence, compliance and poor prognosis for quality health outcomes.[9] Depression in the diabetes population has been associated with potential socio-demographic and clinical factors.[7] Ageing,[2] ethnicity,[8] socio-economic status,[10] education level,[11] and unemployment[12] were important correlates for depression among people with diabetes.

Common diabetes vascular complications like ischemic heart disease (IHD), cerebrovascular accidents (CVA) and diabetic nephropathy had caused significant rates of mortality and poor quality of life.[2,11] Malaysia topped the world in diabetic nephropathy, with almost 15,000 patients requiring dialysis and 2000 acquiring kidney transplants.[13] Diabetes related complications and associated co-morbidities have been proven to amplify psychiatric conditions.[2]

Numerous studies from developed and developing countries assessed factors affecting anxiety and depression among people with diabetes.[2,6,14] Irish and Mexican studies concluded that the prevalence of anxiety and depression was considerably higher among people with diabetes in comparison to the general population.[6,9] A Malaysian study recommended that early psychiatric screening was required owing to elevated risks for anxiety and depression among people with diabetes.[8] This study aimed to determine the prevalence and factors associated with anxiety and depression among outpatients with diabetes in a Malaysian public hospital.

METHODS

Study Setting and Population

This cross-sectional single-center study was conducted in the month of September 2013 among all 169 patients with type 2 diabetes aged between 18 to 90 years who acquired follow-up treatment from the Endocrinology Clinic at the Medical Outpatient Department (MOPD) of Tengku Ampuan Rahimah Hospital (HTAR), Selangor, Malaysia. Objectives and benefits of the study were explained in verbal and written form attached to the questionnaires. Patients were assured that their participation was confidential and would not affect their medical treatment outcomes. A written consent was obtained from those who agreed to participate. Patients with type 1 diabetes and gestational diabetes were excluded from the study.

Ethical Issues

This study complied with the guidelines convened in the Declaration of Helsinki. The study was conducted as part of a larger study that explored anxiety and depression among outpatients in Malaysia. Study protocol was approved by the Medical Research Ethics Committee (MREC), Ministry of Health Malaysia (NMRR-13-643-14711).

Study Instruments

A self-administered questionnaire consisting of three parts was used in this study:

The first part included items on socio-demographics (gender, age, ethnicity, marital status, education level, residence, monthly household income, and employment status).

The second part assessed anxiety and depression among patients with diabetes.. Anxiety is defined as subjective experience of fear and its' physical manifestations while depression is defined as anhedonia (reduced positive affect).[15] To explore anxiety and depression among patients with diabetes, we used the Hospital Anxiety and Depression Scale (HADS), originally developed by Zigmond and Snaith,[16] and validated among Malaysian population.[17] This widely used self-assessment tool measures the level of emotional distress (anxiety and depression) in various clinical settings, including diabetes population.[2,6,18] HADS is comprised of fourteen items, seven of which measures anxiety (HADS-A) and another seven measures depression (HADS-D). These items are scored on a four-point Likert scale ranging from zero (not present) to three (considerable). Item scores were summed to provide sub-scaled scores of anxiety and depression, ranged between 0-21, and total summed score ranged from 0-42. A higher score represents higher anxiety or depression.[18] The scores are categorized as follows: Normal (0-7)

and caseness which includes mild distress (8-10), moderate distress (11-14) and severe distress (15-21).[18] The questionnaire was administered in English.

The third part included clinical health information of the patients derived from medical records:

Baseline Data Definitions

Type 2 Diabetes

The presence of diabetes diagnosed by a physician with a fasting plasma glucose value of 7.0 mmol/l (126 mg/dl) or higher,[19] and patients currently being administered with oral hypoglycemic drugs or insulin therapy as documented in medical records were included in this study.

Diabetes Vascular Complications

Vascular complications in diabetes were considered when patients were diagnosed with cerebrovascular accident (CVA), ischemic heart disease (IHD) or nephropathies. Patients diagnosed with either one vascular complication over the past year were included in this study. Cerebrovascular accident (CVA) was defined as hemiparesis cases proven by medical and CT scan records.[20] Ischemic heart disease (IHD) was considered to exist with a history of angina or acute coronary syndromes (ACS) elicited among patients with diabetes and documented in medical records.[2] Nephropathy is defined by proteinuria > 500 mg in 24 hours among patients with diabetes from medical records.[1]

Diabetes Co-morbid Conditions

Patients with diabetes were classified as hypertensive if they were previously diagnosed and were currently on anti-hypertensive medications[2] as documented in medical records. Dyslipidemia was defined as high plasma triglyceride concentration, low HDL cholesterol

concentration and increased concentration of LDL-cholesterol[21] with patients currently on statin medications as documented in medical records.

The Malaysian Healthcare System

Public healthcare providers across the nation are mainly entrusted by the Ministry of Health Malaysia with the commitment of "healthcare access to all".[4] The public healthcare is highly subsidized through general revenue and taxation collected by the federal government, and with a minimal registration fee of USD 0.33 or MYR 1, Malaysians are granted free access to clinical consultations, treatment and medications both as outpatients or inpatients in all public health facilities within the country.[4] HTAR is the second busiest public health facility in terms of patient admissions and outpatient services in Malaysia at the time of this study.[4]

Statistical analysis

Analysis was performed using Statistical Package for Social Sciences (SPSS®) (version 16.0, IBM, Armonk, NY). Descriptive analysis was performed for all variables in this study. To check for the validity of the Hospital Anxiety and Depression Scale (HADS) among Malaysian population , an exploratory factor analysis was performed using principal component method with varimax rotation and Cronbach's alpha was used to test the internal consistency of the scale. Anxiety and depression scores were expressed as mean and standard deviations. Test of normality was performed for total anxiety and depression sub-scale scores. T-test and ANOVA test were applied to compare anxiety and depression across socio-demographic and clinical health variables. In case of ANOVA, post hoc test was used to determine where the significant difference was. Multiple linear regression analysis using "Enter" technique was employed to obtain significant factors associated with anxiety and depression among patients with diabetes .

The accepted level of significance was set below 0.05 ($p<0.05$). Multicollinearity was checked between independent variables.

RESULTS

Socio-demographic characteristics and clinical health information of the respondents

One hundred sixty nine patients were included in this study. Of the total, 99 (58.6%) were males and 70 (41.4%) were females. The mean (±SD) age of the patients was 36.9 (±15.9) years and the majority aged less than 50 years old 137 (81.1%) (Table 1). j

Baseline clinical data of the patients are summarized in Table (2). Of the total patients, fifty three (31.4%) were diagnosed for diabetes vascular complications. Twelve patients (7.1%) were diagnosed for cerebrovascular accident (CVA), 24 (14.2%) were diagnosed for ischemic heart disease (IHD) and 17 (10.1%) developed nephropathy. Forty four (26.0%) patients developed at least one co-morbid condition while 21 (12.4%) had two co-morbid conditions. Cronbach's alpha coefficient for HADS-A subscale was 0.83 while Cronbach's alpha coefficient for HADS-D subscale was 0.71. Mild anxiety and depression were found in 33 (19.5%) and 49 (29.0%) of the patients respectively. Moderate anxiety and depression were found in 16 (9.5%) patients respectively. Severe anxiety and depressive symptoms were detected in 4 (2.4%) and 3 (1.8%) of the patients respectively.

Association between anxiety and depression and socio-demographics of the respondents

Table (3) shows the association between anxiety and depression with socio-demographic characteristics. Patients aged 50 years or older had higher anxiety score (9.1 ± 4.6) compared to those aged less than 50 years old (6.4 ± 2.7; $p<0.001$). Significant associations were observed

between anxiety and ethnicity (p<0.001), a post hoc tests showed that Indians exhibited higher anxiety score (8.4 ± 4.2) in comparison to Chinese (6.6 ± 2.4, p=0.044). Patients graduated from high school exhibited higher anxiety score (7.5 ± 4.0) in comparison to those with a tertiary degree (6.4 ± 2.5; p=0.037). In addition, patients aged 50 years or older were more depressed (9.2 ± 4.0) in comparison to those aged less than 50 years old (6.3 ± 2.9; p<0.001). Significant associations were observed between depression and ethnicity (p<0.001), post hoc tests revealed that Indians exhibited higher depression (9.8 ± 3.5) in comparison to Malays (6.9 ± 3.1) and Chinese (5.9 ± 2.9; p<0.001 respectively). Similarly, patients graduated from high school exhibited greater depression (7.7 ± 3.7) in comparison to tertiary graduates (6.2 ± 2.9; p=0.006). Patients with a monthly household income of less than MYR3000 have higher depression score (8.7 ± 3.6) compared to those with higher income (6.0 ± 2.8; p<0.001). Similarly, unemployed patients portrayed higher depression score (7.9 ± 3.2) in comparison to those being employed (6.4 ± 3.3, p=0.007).

Association between anxiety and depression and clinical health information of the respondents

Patients diagnosed for ischemic heart disease (IHD) exhibited higher anxiety score (8.7 ± 4.2) in comparison to those without such complication (6.6 ± 3.1; p=0.004). In addition, significant associations were observed between depression and disease co-morbidities (p=0.010), a post hoc tests showed that patients with associated hypertension or dyslipidemia had higher depression score (7.5 ± 3.2) in comparison to those without co-morbid conditions (6.3 ± 3.4, p=0.009) (Table 4).

Factors associated with anxiety among patients with diabetes by multiple linear regression

Table (5) exhibits the factors associated with anxiety among patients with diabetes. Patients aged ≥50 years had on the average 2.3 (95% CI 0.9-3.6) higher anxiety score in comparison to those aged less than 50 years old (p=0.001). Indians had on the average 1.7 (95% CI 0.3-3.2) higher anxiety score compared to Malays (p=0.018). Patients diagnosed with ischemic heart disease (IHD) had on the average 1.5 (95% CI 0.1-2.9) higher anxiety score in comparison to those without such condition (p=0.039).

Factors associated with depression among patients with diabetes by multiple linear regression

Table (6) shows the factors associated with depression among patients with diabetes. Patients aged ≥50 years had on the average 1.4 (95% CI 0.2-2.7) higher depression score in comparison to those aged less than 50 years old (p=0.027). Indians had on the average 2.7 (95% CI 1.4-4.0) higher depression score compared to Chinese (p<0.001). Patients with a monthly household income of less than MYR3000 had on the average 1.9 (95% CI 0.8-3.0) higher depression score compared to those with a higher income (p=0.001).

DISCUSSION

This study aimed to determine the prevalence and factors associated with anxiety and depression among diabetes outpatients in Malaysia. Of the 169 patients with diabetes surveyed, 31.4% perceived anxious states while 40.3% exhibited depressive symptoms. The estimated rate of anxiety reported in this study was similar to an Irish sample (32.0%),[6] but relatively lower than that found in Mexican (52.9%)[9] and Pakistani (57.9%) subjects.[2] In contrary, self-reported depression rates reported in this study were similar than that found in Mexican (47.7%)[9] and Pakistani (43.5%) samples,[2] but comparatively higher than that found in Irish subjects (22.4%).[6] In the final model, age, ethnicity and history of ischemic heart disease were significantly

associated with anxiety, while factors that significantly associated with depression were age, ethnicity and monthly household income.

Ageing appears to accelerate diabetes vascular complications and hyperglycemic crisis, causing poor functional status and high mortality rates.[22] Dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis and over-activation of the sympathetic nervous system due to fear of hypoglycemia, complications or mortality are immediate physiological processes that prompts higher anxiety states among older population.[5] This study found a significantly higher anxious state among older patients compared to younger ones. Collins et al.[6] reported otherwise.

The development of vascular complications is a predictive factor for psychological morbidity among people with diabetes.[23] This study found a significantly higher anxiety level among patients with ischemic heart disease. Khuwaja et al.[2] reported similar associations.

The increased susceptibility to various diseases, disabilities and social isolation among older population causes serious psychological repercussions.[24] This study found a significantly higher depression score among older patients in comparison to younger ones. Similar findings were found among patients with diabetes in other countries. [2,25]

Latest statistics revealed by the Ministry of Health Malaysia reported that the prevalence of diabetes was the highest among Indian ethnic (24.9%), followed by Malay ethnic (17.0%) and Chinese ethnic (13.9%).[4] Minority ethnic groups have been known to experience higher anxiety and depression rates.[26,27] This study found a significantly higher anxiety and depression level among Indian patients in comparison to other ethnicities. A recent Malaysian study which reported similar associations postulated that minority ethnic Indians experienced extensive psychological co-morbidities due to triadic stressors of socio-economic constraints, poor education level and perceived discrimination.[8]

Higher depression states in unemployment is caused by reduced sociological functions such as status identity, social contacts, participation in collective purposes and regular activities.[12] This study found a significantly higher depression status among unemployed patients in comparison to those being employed. Kaur et al.[8] reported similar consistencies. In addition, this study found a significantly higher depression level in lower income patients. Similar findings were reported in a Malaysian study.[8] Reduced confidence due to economic instability and increased healthcare expenditures for routine diabetes screening complications, co-morbid conditions and adherence to treatment pose substantial psychological illness among people with diabetes.[9]

Diabetes co-morbid conditions like hypertension and dyslipidemia has been known to amplify disease complications and poor treatment outcomes.[21,28] Increased rates of depression have been found in diabetes patients with hypertension.[28] An exponential rise of mortality rates due serious cardiovascular disease complications in dyslipidemia would contribute to high depression rates among patients with diabetes due reduced quality of life and poor prognosis.[7,21] This study found a significantly higher depression score among diabetes patients with hypertension or dyslipidemia. Khuwaja et al.[2] found similar findings.

Higher education attainment has been linked to be a protective factor against anxiety and depression among people with diabetes.[6,11,29] Education drives individuals towards proper understanding of disease mechanisms and complications, prompting increased compliance and adherence towards disease treatment for better health outcomes. Our study found a significantly lower anxiety and depression level among tertiary educated patients in comparison to high school graduates.

LIMITATIONS

The absence of a control group and a small sample size from a single hospital might limit the generalizability of the study findings. In addition, the heterogeneity of the sample in this study caused by the wide range of age affects the prevalence rates and may limit the exploration of anxiety and depression in the youngest age groups. The cross-sectional design of the study limits our ability to make causal inferences. Further research is needed to address these limitations.

CONCLUSION

Socio-demographics and clinical factors were important correlates of anxiety and depression among patients with diabetes. Age, ethnicity and ischemic heart disease (IHD) were significantly associated with anxiety. Factors significantly associated with depression were age, ethnicity, and monthly household income.

RECOMMENDATIONS

Early recognition of vulnerable factors associated with anxiety and depression in people with diabetes are necessary to promote patient adherence and compliance to diabetes control. Collaborative teamwork between healthcare providers and patients through compassionate holistic approach in recognizing early neurotic features is essential to prevent disease co-morbidities and mortalities. Rejuvenating primary health care policies from an essentially *'reactive based system'* (responding only when individuals are sick) to a *'proactive based system'* (focus on overall mental and physical health well-being) needs to be drafted immediately and amalgamated in all public health facilities within Malaysia. Increasing patient awareness to boost self-determination and confidence through integrated psychological and medical care in

the management of diabetes would catalyze optimal health outcomes, as mused Osler (1961) in his epitaph;

"Care more for the individual patient than for the special features of the disease...Put yourself in his place... The kindly word, the cheerful greeting, the sympathetic look - these the patient understands."

Sir William Osler (Aphorisms from his bedside teachings and writings, 1961)

Footnotes:

Funding statement: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Contributors: KG had the original idea, designed the study, drafted the first version of the manuscript and is responsible for the final version. PR and MRAM assisted with the study design, data collection, the literature research and editing of the manuscript. KG and SARA contributed to the study coordination, data analysis and preparation of the manuscript. SARA revised the final draft critically for important intellectual content. All authors have contributed to and approved the final manuscript.

Competing interests: None declared.

Data Sharing Statement: No additional data available.

REFERENCES:

1. Fowler *MJ.* Microvascular and macrovascular complications of diabetes. *Clinical Diabetes* 2008; 26: 77-82.

2. Khuwaja AK, Lalani S, Dhanani R, *et al.* Anxiety and depression among outpatients with type 2 diabetes: a multi-centre study of prevalence and associated factors. *Diabetology & Metabolic Syndrome* 2010; 2: 72.

3. International Diabetes Federation. *Diabetes Atlas* 2010; 4. http://www. worlddiabetesfoundation.org/composite-35.htm. *Last accessed 23 December 2013.*

4. Statistics Malaysia and health facts. *Ministry of Health Malaysia*2014. www.moh.gov.my. *Last accessed 31 March 2014.*

5. Gonzalez JS, Sabrina A, Havah E, *et al.* Psychological issues in adults with type 2 diabetes - psychological co-morbidities of physical illness: a behavioral medicine perspective. *Springer Science Business Media LLC* 2011; 2: 73-121.

6. Collins MM, Corcoran P, Perry IJ. Anxiety and depression symptoms in patients with diabetes. *Diabetic Medicine* 2009; 26: 153–161.

7. Engum A, Mykletun A, Midthjell K, *et al.* Depression and diabetes - a large population-based study of sociodemographic, lifestyle, and clinical factors associated with depression in type 1 and type 2 diabetes. *Diabetes Care* 2005; 28: 1904–9.

8. Kaur G, Tee GH, Ariaratnam S, *et al.* Depression, anxiety and stress symptoms among diabetics in Malaysia: a cross sectional study in an urban primary care setting. *BMC Family Practice* 2013; 14: 69.

9. Tovilla-Zarate C, Juarez-Rojop I, Jimenez YP, *et al.* Prevalence of anxiety and depression among outpatients with Type 2 diabetes in the Mexican population. *Plos One* 2012: 7: e36887.

10. Everson SA, Maty SC, Lynch JW, *et al.* Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. *J Psychosom Res* 2002; 53:891– 95.

11. Peyrot M, Rubin R. Levels and risks of depression and anxiety symptomatology among diabetic adults. *Diabetes Care* 1997; 20: 585–90.

12. Palizgir M, Bakhtiari M, Esteghamati A. Association of depression and anxiety with diabetes mellitus type 2 concerning some sociological factors. *Iranian Red Crescent Medical Journal* 2013; 15: 644-48.

13. National Renal Registry Malaysia. *Clinical Research Center Ministry of Health Malaysia* 2006. www.crc.gov.my. *Last accessed 15 November 2013*

14. Katon W, Unutzer J, Russo J. Major depression: the importance of clinical characteristics and treatment response to prognosis. *Depression and Anxiety* 2010; 27:19–26.

15. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) 2000; 4.

16. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983; 67: 361–70.

17. Fatt QK, Atiya AS, Heng NGC, *et al.* Validation of the Hospital Anxiety and Depression Scale and the psychological disorder among premature ejaculation subjects. *International Journal of Impotence Research* 2007; 19: 321–25.

18. Whelan-Goodinson R, Ponsford J. Validity of the Hospital Anxiety and Depression Scale to assess depression and anxiety following traumatic brain injury as compared with the Structured Clinical Interview for DSM-IV. *Journal of Affective Disorders* 2009; 114: 94-102.

19. American Diabetes Association. Standards of medical care in diabetes. *Diabetes Care* 2006; 29:4–42.

20. Vaz NC, Ferreira AM, Kulkarni MS, et al. Prevalence of diabetic complications in rural Goa, India. *Indian J Community Med* 2011; 36: 283–6.

21. Mooradian AD. Dyslipidemia in type 2 diabetes mellitus. *Nature Clinical Practice: Endocrinology & Metabolism* 2009; 5: 150-9.

22. Morley JE. The elderly type 2 diabetic patient: special considerations. Diabetic Medicine 1998; 15: 41-6.

23. Almawi W, Tamim H, Al-Sayed N, *et al.* Association of comorbid depression, anxiety, and stress disorders with Type 2 diabetes in Bahrain, a country with a very high prevalence of type 2 diabetes. *Journal of Endocrinological Investigation* 2008; 31: 1020–24.

24. Ganatra HA, Zafar SN, Qidwai W, *et al.* Prevalence and predictors of depression among an elderly population of Pakistan. *Aging Ment Health* 2008; 12:349-56.

25. Mosaku K, Kolawole B, Mume C, *et al.* Depression, anxiety and quality of life among diabetic patients: a comparative study. *Journal of the National Medical Association* 2008; 100: 73–8.

26. Dunlop DD, Song J, Lyons JS, *et al.* Racial or ethnic differences in rates of depression among preretirement adults. *Am J Public Health* 2003; 93:1945–952.

27. Fisher L, Laurencin G, Chesla CA, *et al.* Depressive affect among four ethnic groups of male patients with type 2 diabetes. *Diabetes Spectr* 2004; 17:215–19.

28. Thomas J, Jones G, Scarinci I, *et al.* A descriptive and comparative study of the prevalence of depressive and anxiety disorders in low-income adults with type 2 diabetes and other chronic illnesses. *Diabetes Care* 2003; 26:2311–17.

29. Bener A, Al-Hamaq AO, Dafeeah EE. High prevalence of depression, anxiety and stress symptoms among diabetes mellitus patients. *The Open Psychiatry Journal* 2011; 5: 5-12.

Table 1: Socio-demographic characteristics of the respondents (n=169)

Characteristics	N	Percentage (%)
Gender		
Male	99	58.6
Female	70	41.4
Age (years)		
< 50	137	81.1
≥ 50	32	18.9
Ethnicity		
Malay	53	31.3
Chinese	88	52.1
Indian	28	16.6
Marital status		
Single	63	37.3
Married	106	62.7
Highest education level		
High school	75	44.4
Tertiary education	94	55.6
Residence		
Urban	132	78.1
Rural	37	21.9
Monthly household income (MYR)		
< 3000	56	33.1

≥ 3000	113	66.9
Current employment status		
Employed	119	70.4
Unemployed	50	29.6

* 1MYR is equivalent to 0.33USD at the time of study

Table 2: Clinical health information of the respondents (n=169)

Characteristics	N	Percentage (%)
Diabetes vascular complications		
Cerebrovascular accident (CVA)		
Yes	12	7.1
No	157	92.9
Ischemic heart disease (IHD)		
Yes	24	14.2
No	145	85.8
Diabetic nephropathy		
Yes	17	10.1
No	152	89.9
Co-morbidities		
Diabetes alone	104	61.6
Diabetes with hypertension or dyslipidemia	44	26.0
Diabetes with hypertension and dyslipidemia	21	12.4
Anxiety		
Normal	116	68.6
Mild	33	19.5
Moderate	16	9.5
Severe	4	2.4

Depression		
Normal	101	59.7
Mild	49	29.0
Moderate	16	9.5
Severe	3	1.8

Table 3: Association between anxiety and depression with socio-demographic characteristics of the respondents (n=169)

Characteristics	**Anxiety**		**Depression**	
	Mean (SD)	**P-value**	**Mean (SD)**	**P-value**
Gender				
Male	7.0 (3.5)		7.1 (3.5)	
Female	6.8 (3.0)	0.737	6.6 (3.1)	0.345
Age (years)				
< 50	6.4 (2.7)		6.3 (2.9)	
≥ 50	9.1 (4.6)	< 0.001	9.2 (4.0)	<0.001
Ethnicity				
Malay	6.5 (3.8)		6.9 (3.1)	
Chinese	6.6 (2.4)		5.9 (2.9)	
Indian	8.4 (4.2)	0.035	9.8 (3.5)	< 0.001
Marital status				
Single	6.7 (2.7)		6.9 (2.9)	
Married	7.0 (3.6)	0.601	6.8 (3.6)	0.894
Highest education level				
High school	7.5 (4.0)		7.7 (3.7)	
Tertiary education	6.4 (2.5)	0.037	6.2 (2.9)	0.006
Residence				
Urban	6.8 (2.9)		6.7 (3.1)	

Rural	7.2 (4.5)	0.569	7.6 (3.9)	0.125
Monthly household income (MYR)				
< 3000	7.5 (4.4)		8.7 (3.6)	
≥ 3000	6.6 (2.6)	0.090	6.0 (2.8)	<0.001
Current employment status				
Employed	6.6 (3.2)		6.4 (3.3)	
Unemployed	7.6 (3.4)	0.078	7.9 (3.2)	0.007

Table 4: Association between anxiety and depression with clinical health information of the respondents (n=169)

Characteristics	Anxiety		Depression	
	Mean (SD)	P-value	Mean (SD)	P-value
Diabetes vascular complications				
Cerebrovascular accident (CVA)				
Yes	6.6 (4.1)		6.7 (4.8)	
No	6.9 (3.3)	0.742	6.9 (3.2)	0.823
Ischemic heart disease (IHD)				
Yes	8.7 (4.2)		7.8 (4.1)	
No	6.6 (3.1)	0.004	6.7 (3.2)	0.131
Diabetic nephropathy				
Yes	7.4 (2.2)		6.4 (3.0)	
No	6.8 (3.4)	0.492	6.9 (3.4)	0.548
Co-morbidities				
Diabetes alone	6.6 (3.3)		6.3 (3.4)	
Diabetes with hypertension or dyslipidemia	7.2 (3.4)		7.5 (3.2)	
Diabetes with hypertension and dyslipidemia	7.7 (3.0)	0.289	8.4 (2.9)	0.010

Table 5: Factors associated with anxiety among patients with diabetes by multiple linear regression (n=169)

Predictors	B	SE	Beta	P-value	95% CI	
					Lower	Upper
Age (Years)						
< 50	Ref	Ref	Ref	Ref	Ref	Ref
≥ 50	2.3	0.7	0.3	0.001	0.9	3.6
Ethnicity						
Malay	Ref	Ref	Ref	Ref	Ref	Ref
Chinese	0.7	0.6	0.1	0.194	-0.4	1.8
Indian	1.7	0.7	0.2	0.018	0.3	3.2
Highest education level						
High school	0.1	0.5	0.0	0.871	-1.0	1.1
Tertiary educated	Ref	Ref	Ref	Ref	Ref	Ref
Having ischemic heart disease (IHD)						
Yes	1.5	0.7	0.2	0.039	0.1	2.9
No	Ref	Ref	Ref	Ref	Ref	Ref

Table 6: Factors associated with depression among patients with diabetes by multiple linear regression (n=169)

Predictors	B	SE	Beta	P-value	95% CI	
					Lower	Upper
Age (Years)						
< 50	Ref	Ref	Ref	Ref	Ref	Ref
≥ 50	1.4	0.6	0.2	0.027	0.2	2.7
Ethnicity						
Malay	0.4	0.5	0.1	0.458	-0.7	1.4
Indian	2.7	0.7	0.3	<0.001	1.4	4.0
Chinese	Ref	Ref	Ref	Ref	Ref	Ref
Highest education level						
High school	-0.3	0.5	-0.1	0.548	-1.4	0.7
Tertiary educated	Ref	Ref	Ref	Ref	Ref	Ref
Monthly household income (MYR)						
< 3000	1.9	0.6	0.3	0.001	0.8	3.0
≥ 3000	Ref	Ref	Ref	Ref	Ref	Ref
Current employment status						
Employed	Ref	Ref	Ref	Ref	Ref	Ref
Unemployed	-1.7	1.5	-0.2	0.265	-4.7	1.3
Co-morbidities						
Diabetes alone	Ref	Ref	Ref	Ref	Ref	Ref
Diabetes with hypertension or dyslipidemia	-2.6	1.5	-0.4	0.080	-5.5	0.3
Diabetes with hypertension and dyslipidemia	-2.3	1.7	-0.2	0.189	-5.7	1.1

Factors associated with anxiety and depression among type 2 ~~diabetic~~diabetes outpatients in Malaysia: ~~A~~a descriptive cross-sectional single-center study

Kurubaran Ganasegeran[1*], Pukunan Renganathan[2], Rizal Abdul Manaf[3], Sami Abdo Radman Al-Dubai[4]

[1] International Medical School, Management and Science University (MSU), Shah Alam, Selangor, Malaysia.

[2] Clinical Research Center, Tengku Ampuan Rahimah Hospital (HTAR), Klang, Selangor, Malaysia.

[3] Community Health Department, Faculty of Medicine, Universiti Kebangsaan Malaysia (UKM), Kuala Lumpur, Malaysia.

[4] Department of Community Medicine, International Medical University (IMU), Kuala Lumpur, Malaysia.

*** Corresponding author:**

Dr. Kurubaran Ganasegeran, BMedSc (Hons), MBBS
International Medical School, Management and Science University (MSU), University Drive, Off Persiaran Olahraga, Section 13, 40100, Shah Alam, Selangor, Malaysia
Email: medkuru@yahoo.com
Tel: +60193711268

ABSTRACT

Objective: To determine the ~~factors~~prevalence and factors associated with anxiety and depression among ~~diabetic~~ type 2 diabetes outpatients in Malaysia.

Design: Descriptive, cross-sectional single-center study ~~– mixed methods (survey and retrospective patient data)~~ with universal sampling of all ~~diabetic~~ patients with type 2 diabetes.~~subjects.~~

Setting: Endocrinology Clinic of Medical Outpatient Department (MOPD) in a Malaysian public hospital.

Participants: All 169 ~~type 2 diabetic~~ patients with type 2 diabetes ~~subjects~~ (Males, n=99; Females, n=70) aged between ~~13~~18-90 years ~~old that~~ who acquired follow-up treatment from the Endocrinology Clinic in the month of September 2013.

Main outcome measures: The validated Hospital Anxiety and Depression Scale (HADS), socio-demographic characteristics and clinical health information from patient records.

Results: Of the total 169 ~~diabetics~~patients surveyed, anxiety and depression were found in 53 (31.4%) and 68 (40.3%) respectively. In multivariate analysis, age, ethnicity and ischemic heart disease (IHD) were ~~predictors~~significantly associated with ~~of~~ anxiety, while age, ethnicity and monthly household income were ~~predictors of~~significantly associated with depression.

Conclusion: Socio-demographics and clinical health factors were important correlates of anxiety and depression among ~~diabetics~~patients with diabetes. Integrated psychological and medical care to boost self-determination and confidence in the management of diabetes would catalyze optimal health outcomes among ~~diabetic~~ patients with diabetes.~~subjects.~~

Strengths and limitations of this study

- Malaysia suffers the highest rate of ~~diabetics~~diabetes in the Asian region. ~~Diabetics~~People with diabetes are twice more likely to develop anxiety and depression, causing poor health outcomes and increased mortality.
- This study aimed to assess the prevalence and factors associated with anxiety and depression among ~~diabetic~~type 2 diabetes outpatients in Malaysia.
- Integrated psychological and medical care to boost self-determination and confidence in the management of diabetes would catalyze optimal health outcomes among ~~diabetic~~ patients with diabetes. ~~subjects~~.
- The absence of a control group and a relatively small sample size from one hospital might limit the generalizability of the study findings. The cross-sectional design of the study limits our ability to make causal inferences.

INTRODUCTION

Type 2 diabetes is a chronic metabolic disorder characterized by hyperglycemia due to insulin deficiency.[1] The global prevalence of diabetes is currently estimated to be 285 million and projection rates are expected to rise to over 438 million by the year 2030,[2] with Asia suffering the bulk of the total ~~diabetic~~diabetes epidemic.[3] The Malaysian scenario is more debilitating when figures confirmed that the country suffers the highest rate of ~~diabetics~~diabetes in the Asian region, with prevalence rates rising from 14.9% in 2006 to 20.8% in 2011.[4]

The complex mechanism to cope with chronic diseases requires self-determination to overcome the emotional shock of the diagnoses and proper assimilation of information regarding self-care to prevent disease complications.[5] The collapse of these coping strategies over time due to low psychological, emotional, and social support renders significant co-morbid anxiety and depression, exacerbating disease complications and poor prognosis.[5] ~~Diabetics~~People with diabetes were twice at risks to suffer from pre-morbid anxiety and depression as the general population.[2,6] The co-existence of anxiety and depression in ~~diabetic subjects~~people with diabetes catalyzes serious disease co-morbidities, complications, poor quality of life and escalated health care expenditures.[7]

Anxious and depressed ~~diabetic subjects~~people with diabetes are less likely to comply with diabetes self-care recommendations.[6] The diagnosis of diabetes is a life threatening stressor that demands high mental and physical accommodations due to elevated feelings of fear.[8] Depression among ~~diabetics~~people with diabetes adds an increased burden to patient adherence, compliance and poor prognosis for quality health outcomes.[9] Depression in the ~~diabetic~~diabetes population has been associated with potential socio-demographic and clinical factors.[7] Ageing,[2]

ethnicity,[8] socio-economic status,[10] education level,[11] and unemployment[12] were important correlates for ~~diabetic~~ depression~~.~~ among people with diabetes.

Common ~~diabetic~~diabetes vascular complications like ischemic heart disease (IHD), cerebrovascular accidents (CVA) and diabetic nephropathy had caused significant rates of mortality and poor quality of life.[2,11] Malaysia topped the world in diabetic nephropathy, with almost 15,000 ~~subjects~~patients requiring dialysis and 2000 acquiring kidney transplants.[13] ~~Diabetic~~Diabetes related complications and associated co-morbidities have been proven to amplify psychiatric conditions.[2]

Numerous studies from developed and developing countries assessed factors affecting anxiety and depression among ~~diabetic subjects~~people with diabetes.[2,6,14] Irish and Mexican studies concluded that the prevalence of anxiety and depression was considerably higher among ~~diabetic subjects~~people with diabetes in comparison to the general population.[6,9] A Malaysian study recommended that early psychiatric screening was required owing to elevated risks for anxiety and depression among ~~diabetic subjects~~people with diabetes.[8] This study aimed to determine the prevalence and factors associated with anxiety and depression among ~~diabetic outpatients~~outpatients with diabetes in a Malaysian public hospital.

METHODS

Study Setting and Population

This cross-sectional single-center study was conducted in the month of September 2013 among all 169 patients with type 2 diabetes~~diabetic subjects~~ aged between ~~13~~18 to 90 years who acquired follow-up treatment from the Endocrinology Clinic at the Medical Outpatient Department (MOPD) of Tengku Ampuan Rahimah Hospital (HTAR), Selangor, Malaysia. Objectives and benefits of the study were explained in verbal and written form attached to the

questionnaires. ~~Subjects~~Patients were assured that their participation was confidential and would not affect their medical treatment outcomes. A written consent was obtained from those who agreed to participate. ~~Subjects~~Patients with type 1 diabetes and gestational diabetes were excluded from the study.

Ethical Issues

This study complied with the guidelines convened in the Declaration of Helsinki. The study was conducted as part of a larger study that explored anxiety and depression among outpatients in Malaysia. Study protocol was approved by the Medical Research Ethics Committee (MREC), Ministry of Health Malaysia (NMRR-13-643-14711).

Study Instruments

A self-administered questionnaire consisting of three parts was used in this study:

The first part included items on socio-demographics (gender, age, ethnicity, marital status, education level, residence, monthly household income, and employment status).

The second part assessed anxiety and depression among patients with diabetes.~~diabetic subjects~~. Anxiety is defined as subjective experience of fear and its' physical manifestations while depression is defined as anhedonia (reduced positive affect).[15] To explore anxiety and depression among patients with diabetes,~~diabetic subjects,~~ we used the Hospital Anxiety and Depression Scale (HADS), originally developed by Zigmond and Snaith,[16] and validated among Malaysian population.[17] This widely used self-assessment tool ~~screens~~measures the level of emotional distress (anxiety and depression) in various clinical settings, including ~~diabetic~~diabetes population.[2,6,18] HADS is comprised of fourteen items, seven of which measures anxiety (HADS-

Formatted: Space After: 0 pt

A) and another seven measures depression (HADS-D). These items are scored on a four-point Likert scale ranging from zero (not present) to three (considerable). Item scores were summed to provide sub-scaled scores of anxiety and depression, ranged between 0-21, and total summed score ranged from 0-42. A higher score represents higher anxiety or depression.[18] The scores are categorized as follows: Normal (0-7) and caseness which includes mild distress (8-10), moderate distress (11-14) and severe distress (15-21).[18] The questionnaire was administered in English.

The third part included clinical health information of the ~~subjects~~patients derived from medical records:

Baseline Data Definitions

Type 2 Diabetes

The presence of diabetes diagnosed by a physician with a fasting plasma glucose value of 7.0 mmol/l (126 mg/dl) or higher,[19] and ~~subjects~~patients currently being administered with oral hypoglycemic drugs or insulin therapy as documented in medical records were included in this study.

Diabetes Vascular Complications

Vascular complications in diabetes were considered when patients~~subjects~~ were diagnosed with cerebrovascular accident (CVA), ischemic heart disease (IHD) or nephropathies. Patients ~~Subjects~~ diagnosed with either one vascular complication over the past year were included in this study. Cerebrovascular accident (CVA) was defined as hemiparesis cases proven by medical and CT scan records.[20] Ischemic heart disease (IHD) was considered to exist with a history of angina or acute coronary syndromes (ACS) elicited among patients with diabetes ~~diabetic subjects~~ and documented in medical records.[2] Nephropathy is defined by proteinuria > 500 mg in 24 hours among patients with diabetes ~~diabetic cases~~ from medical records.[1]

Diabetes Co-morbid Conditions

Patients with diabetes ~~Diabetic subjects~~ were classified as hypertensive if they were previously diagnosed and were currently on anti-hypertensive medications[2] as documented in medical records. Dyslipidemia was defined as high plasma triglyceride concentration, low HDL cholesterol concentration and increased concentration of LDL-cholesterol[21] with patients ~~study subjects~~ currently on statin medications as documented in medical records.

The Malaysian Healthcare System

Formatted: Font: Bold

Public healthcare providers across the nation are mainly entrusted by the Ministry of Health Malaysia with the commitment of "healthcare access to all".[4] The public healthcare is highly subsidized through general revenue and taxation collected by the federal government, and with a minimal registration fee of USD 0.33 or MYR 1, Malaysians are granted free access to clinical consultations, treatment and medications both as outpatients or inpatients in all public health facilities within the country.[4] HTAR is the second busiest public health facility in terms of patient admissions and outpatient services in Malaysia at the time of this study.[4]

Statistical analysis

Analysis was performed using Statistical Package ~~of~~for Social Sciences (SPSS®) (version 16.0, IBM, Armonk, NY). Descriptive analysis was performed for all variables in this study. To check for the validity of the Hospital Anxiety and Depression Scale (HADS) among Malaysian population ~~subjects~~, an exploratory factor analysis was performed using principal component method with varimax rotation and Cronbach's alpha was used to test the internal consistency of the scale. Anxiety and depression scores were expressed as mean and standard deviations. Test of normality was performed for total anxiety and depression sub-scale scores. T-test and

ANOVA test were applied to compare anxiety and depression across socio-demographic and clinical health variables. In case of ANOVA, post hoc test was used to determine where the significant difference was. Multiple linear regression analysis using "Enter" technique was employed to obtain significant factors associated with anxiety and depression among patients with diabetes ~~diabetic subjects~~. The accepted level of significance was set below 0.05 ($p<0.05$). Multicollinearity was checked between independent variables.

RESULTS

Socio-demographic characteristics and clinical health information of the respondents

One hundred sixty nine patients~~subjects~~ were included in this study. Of the total, 99 (58.6%) were males and 70 (41.4%) were females. The mean (±SD) age of the patients~~subjects~~ was 36.9 (±15.9) years and the majority aged less than ~~30~~50 years old 137 (81.1%)~~.~~ (Table 1). ~~The majority of the patientssubjects were Chinese 88 (52.1%), married 106 (62.7%) and residing in an urban area 132 (78.1%). Most patientssubjects were tertiary educated; 94 (55.6%) and currently being employed 119 (70.4%) with a monthly household income of MYR3000 or more 113 (66.9%) (Table 1).~~

~~*Clinical health information of the respondents*~~

Baseline clinical data of the patients~~subjects~~ are summarized in Table (2). Of the total ~~subjects~~patients, fifty three (31.4%) were diagnosed for ~~diabetic~~diabetes vascular ~~macrovascular~~ complications. Twelve patients ~~subjects~~ (7.1%) were diagnosed for cerebrovascular accident (CVA), 24 (14.2%) were diagnosed for ischemic heart disease (IHD) and 17 (10.1%) developed nephropathy. Forty four (26.0%) ~~subjects~~patients developed at least one co-morbid condition while 21 (12.4%) had two co-morbid conditions. Cronbach's alpha coefficient for HADS-A

subscale was 0.83 while Cronbach's alpha coefficient for HADS-D subscale was 0.71. Mild anxiety and depression were found in 33 (19.5%) and 49 (29.0%) of the ~~subjects~~patients respectively. Moderate anxiety and depression were found in 16 (9.5%) ~~subjects~~patients respectively. Severe anxiety and depressive symptoms were detected in 4 (2.4%) and 3 (1.8%) of the ~~subjects~~patients respectively.

Association between anxiety and depression ~~with~~ and socio-demographics of the respondents

Table (3) shows the association between anxiety and depression with socio-demographic characteristics. ~~Subjects~~Patients aged 50 years or older had higher anxiety score (9.1 ± 4.6) compared to those aged less than 50 years old (6.4 ± 2.7; p<0.001). Significant associations were observed between anxiety and ethnicity (p<0.001), a post hoc tests showed that Indians exhibited higher anxiety score (8.4 ± 4.2) in comparison to Chinese (6.6 ± 2.4, p=0.044). ~~Subjects~~Patients graduated from high school exhibited higher anxiety score (7.5 ± 4.0) in comparison to those with a tertiary degree (6.4 ± 2.5; p=0.037). In addition, ~~subjects~~patients aged 50 years or older were more depressed (9.2 ± 4.0) in comparison to those aged less than 50 years old (6.3 ± 2.9; p<0.001). Significant associations were observed between depression and ethnicity (p<0.001), post hoc tests revealed that Indians exhibited higher depression (9.8 ± 3.5) in comparison to Malays (6.9 ± 3.1) and Chinese (5.9 ± 2.9; p<0.001 respectively). Similarly, ~~subjects~~patients graduated from high school exhibited greater depression (7.7 ± 3.7) in comparison to tertiary graduates (6.2 ± 2.9; p=0.006). ~~Subjects~~Patients with a monthly household income of less than MYR3000 have higher depression score (8.7 ± 3.6) compared to those with higher income (6.0 ± 2.8; p<0.001). Similarly, unemployed ~~subjects~~patients portrayed higher depression score (7.9 ± 3.2) in comparison to those being employed (6.4 ± 3.3, p=0.007).

Association between anxiety and depression ~~with~~ and clinical health information of the respondents

~~Subjects~~Patients diagnosed for ischemic heart disease (IHD) exhibited higher anxiety score (8.7 ± 4.2) in comparison to those without such complication (6.6 ± 3.1; p=0.004). In addition, significant associations were observed between depression and disease co-morbidities (p=0.010), a post hoc tests showed that ~~diabetic subjects~~patients with associated hypertension or dyslipidemia had higher depression score (7.5 ± 3.2) in comparison to ~~subjects~~those without co-morbid conditions (6.3 ± 3.4, p=0.009) (Table 4).

~~Predictors of~~Factors associated with anxiety among patients with diabetes ~~diabetics~~ by multiple linear regression

Table (5) exhibits the factors associated with ~~predictors of~~ anxiety among ~~diabetics~~patients with diabetes. ~~Subjects~~Patients aged ≥50 years had on the average 2.3 (95% CI 0.9-3.6) higher anxiety score in comparison to those aged less than 50 years old (p=0.001). Indians had on the average 1.7 (95% CI 0.3-3.2) higher anxiety score compared to Malays (p=0.018). ~~Subjects~~Patients diagnosed with ischemic heart disease (IHD) had on the average 1.5 (95% CI 0.1-2.9) higher anxiety score in comparison to those without such condition (p=0.039).

~~Predictors of~~Factors associated with depression among patients with diabetes ~~diabetics~~ by multiple linear regression

Table (6) shows the factors associated with ~~predictors of~~ depression among ~~diabetics~~patients with diabetes. ~~Subjects~~Patients aged ≥50 years had on the average 1.4 (95% CI 0.2-2.7) higher depression score in comparison to those aged less than 50 years old (p=0.027). Indians had on the average 2.7 (95% CI 1.4-4.0) higher depression score compared to Chinese (p<0.001).

~~Subjects~~Patients with a monthly household income of less than MYR3000 had on the average 1.9 (95% CI 0.8-3.0) higher depression score compared to those with a higher income (p=0.001).

DISCUSSION

This study aimed to determine the prevalence and factors associated with anxiety and depression among ~~diabetic~~diabetes outpatients in Malaysia. Of the 169 ~~diabetic subjects~~patients with diabetes surveyed, 31.4% perceived anxious states while 40.3% exhibited depressive symptoms. The estimated rate of anxiety reported in this study was similar to an Irish sample (32.0%),[6] but relatively lower ~~to~~than that found in Mexican (52.9%)[9] and Pakistani (57.9%) subjects.[2] In contrary, self-reported depression rates reported in this study were similar ~~to~~than that found in Mexican (47.7%)[9] and Pakistani (43.5%) samples,[2] but comparatively higher ~~to~~than that found in Irish subjects (22.4%).[6] In the final model, age, ethnicity and ~~diagnosis~~ history of ischemic heart disease were significantly associated with anxiety, while factors that significantly ~~contributed to~~associated with depression were age, ethnicity and monthly household income.

Ageing appears to accelerate ~~diabetic~~diabetes vascular complications and hyperglycemic crisis, causing poor functional status and high mortality rates.[22] Dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis and over-activation of the sympathetic nervous system due to fear of hypoglycemia, complications or mortality are immediate physiological processes that prompts higher anxiety states among older population.[5] This study found a significantly higher anxious state among older ~~diabetic subjects~~patients compared to younger ones. Collins et al.[6] reported otherwise.

The development of vascular complications is a predictive factor for psychological morbidity among ~~diabetic subjects~~people with diabetes.[23] This study found a significantly higher

anxiety level among patients ~~subjects~~ with ischemic heart disease. Khuwaja et al.[2] reported similar associations.

The increased susceptibility to various diseases, disabilities and social isolation among older population causes serious psychological repercussions.[24] This study found a significantly higher depression score among older ~~subjects~~patients in comparison to younger ones. Similar findings were found among ~~diabetic subjects~~patients with diabetes in other countries. [2,25]

Latest statistics revealed by the Ministry of Health Malaysia reported that the prevalence of diabetes was the highest among Indian ethnic (24.9%), followed by Malay ethnic (17.0%) and Chinese ethnic (13.9%).[4] Minority ethnic groups have been known to experience higher anxiety and depression rates.[26,27] This study found a significantly higher anxiety and depression level among Indian ~~subjects~~patients in comparison to other ethnicities. A recent Malaysian study which reported similar associations postulated that minority ethnic Indians experienced extensive psychological co-morbidities due to triadic stressors of socio-economic constraints, poor education level and perceived discrimination.[8]

Higher depression states in unemployment is caused by reduced sociological functions such as status identity, social contacts, participation in collective purposes and regular activities.[12] This study found a significantly higher depression status among unemployed ~~subjects~~patients in comparison to those being employed. Kaur et al.[8] reported similar consistencies. In addition, this study found a significantly higher depression level in lower income ~~diabetic subjects~~patients. Similar findings were reported in a Malaysian study.[8] Reduced confidence due to economic instability and increased healthcare expenditures for routine ~~diabetic~~diabetes screening complications, co-morbid conditions and adherence to treatment pose substantial psychological illness among people with diabetes~~diabetic subjects~~.[9]

Diabetes co-morbid conditions like hypertension and dyslipidemia has been known to amplify disease complications and poor treatment outcomes.[21,28] Increased rates of depression have been found in ~~diabetic subjects~~diabetes patients with hypertension.[28] An exponential rise of mortality rates due serious cardiovascular disease complications in dyslipidemia would contribute to high depression rates among ~~diabetic subjects~~patients with diabetes due reduced quality of life and poor prognosis.[7,21] This study found a significantly higher depression score among ~~diabetic subjects~~diabetes patients with hypertension or dyslipidemia. Khuwaja et al.[2] found similar findings.

Higher education attainment has been linked to be a protective factor against anxiety and depression among people with diabetes~~diabetic subjects~~.[6,11,29] Education drives individuals towards proper understanding of disease mechanisms and complications, prompting increased compliance and adherence towards disease treatment for better health outcomes. Our study found a significantly lower anxiety and depression level among tertiary educated ~~subjects~~patients in comparison to high school graduates.

LIMITATIONS

~~The major limitations of this study were the~~The absence of a control group and a small sample size from ~~one~~ a single hospital~~. These~~ might limit the generalizability of the study findings. In addition, the heterogeneity of the sample in this study caused by the wide range of age ~~range may effect~~ affects ~~of heterogeneity in this study, causing low~~ the prevalence rates and may limit the ~~ed~~ exploration of anxiety and depression in the youngest age groups. The cross-sectional design of the study limits our ability to make causal inferences. Further research is needed to address these limitations.

CONCLUSION

Socio-demographics and clinical factors were important correlates of anxiety and depression among patients with diabetes. ~~This study found that~~ Age, ethnicity and ischemic heart disease (IHD) were significantly associated ~~of~~with anxiety. ~~Predictors of~~Factors significantly associated with depression ~~among diabetic subjects~~patients with diabetes ~~~~ were age, ethnicity, and monthly household income.

RECOMMENDATIONS

Early recognition of vulnerable factors associated with anxiety and depression in people with diabetes ~~diabetic subjects~~ are necessary to promote patient adherence and compliance to ~~diabetic~~diabetes control. Collaborative teamwork between healthcare providers and patients through compassionate holistic approach in recognizing early neurotic features is essential to prevent disease co-morbidities and mortalities. Rejuvenating primary health care policies from an essentially *'reactive based system'* (responding only when individuals are sick) to a *'proactive based system'* (focus on overall mental and physical health well-being) needs to be drafted immediately and amalgamated in all public health facilities within Malaysia. Increasing patient awareness to boost self-determination and confidence through integrated psychological and medical care in the management of diabetes would catalyze optimal health outcomes, as mused Osler (1961) in his epitaph;

"Care more for the individual patient than for the special features of the disease...Put yourself in his place... The kindly word, the cheerful greeting, the sympathetic look - these the patient understands."

Sir William Osler (Aphorisms from his bedside teachings and writings, 1961)

Contributors: KG had the original idea, designed the study, drafted the first version of the manuscript and is responsible for the final version. PR and MRAM assisted with the study design, data collection, the literature research and editing of the manuscript. KG and SARA contributed to the study coordination, data analysis and preparation of the manuscript. SARA revised the final draft critically for important intellectual content. All authors have contributed to and approved the final manuscript.

Funding statement: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests: None declared.

REFERENCES:

1. Fowler *MJ.* Microvascular and macrovascular complications of diabetes. *Clinical Diabetes* 2008; 26: 77-82.

2. Khuwaja AK, Lalani S, Dhanani R, *et al.* Anxiety and depression among outpatients with type 2 diabetes: a multi-centre study of prevalence and associated factors. *Diabetology & Metabolic Syndrome* 2010; 2: 72.

3. International Diabetes Federation. *Diabetes Atlas* 2010; 4. http://www.worlddiabetesfoundation.org/composite-35.htm. *Last accessed 23 December 2013.*

4. Statistics Malaysia and health facts. *Ministry of Health Malaysia* ~~2013~~2014. www.moh.gov.my. *Last accessed 31 March 2014.*

Formatted: Font: Italic

Formatted: Font: Italic

Formatted: Font: Italic

5. Gonzalez JS, Sabrina A, Havah E, *et al.* Psychological issues in adults with type 2 diabetes - psychological co-morbidities of physical illness: a behavioral medicine perspective. *Springer Science Business Media LLC* 2011; 2: 73-121.

6. Collins MM, Corcoran P, Perry IJ. Anxiety and depression symptoms in patients with diabetes. *Diabetic Medicine* 2009; 26: 153–161.

7. Engum A, Mykletun A, Midthjell K, *et al.* Depression and diabetes - a large population-based study of sociodemographic, lifestyle, and clinical factors associated with depression in type 1 and type 2 diabetes. *Diabetes Care* 2005; 28: 1904–9.

8. Kaur G, Tee GH, Ariaratnam S, *et al.* Depression, anxiety and stress symptoms among diabetics in Malaysia: a cross sectional study in an urban primary care setting. *BMC Family Practice* 2013; 14: 69.

9. Tovilla-Zarate C, Juarez-Rojop I, Jimenez YP, *et al.* Prevalence of anxiety and depression among outpatients with Type 2 diabetes in the Mexican population. *Plos One* 2012: 7: e36887.

10. Everson SA, Maty SC, Lynch JW, *et al.* Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. *J Psychosom Res* 2002; 53:891– 95.

11. Peyrot M, Rubin R. Levels and risks of depression and anxiety symptomatology among diabetic adults. *Diabetes Care* 1997; 20: 585–90.

12. Palizgir M, Bakhtiari M, Esteghamati A. Association of depression and anxiety with diabetes mellitus type 2 concerning some sociological factors. *Iranian Red Crescent Medical Journal* 2013; 15: 644-48.

13. National Renal Registry Malaysia. *Clinical Research Center Ministry of Health Malaysia* 2006. www.crc.gov.my. *Last accessed 15 November 2013*

14. Katon W, Unutzer J, Russo J. Major depression: the importance of clinical characteristics and treatment response to prognosis. *Depression and Anxiety* 2010; 27:19–26.

15. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) 2000; 4.

16. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983; 67: 361–70.

17. Fatt QK, Atiya AS, Heng NGC, *et al.* Validation of the Hospital Anxiety and Depression Scale and the psychological disorder among premature ejaculation subjects. *International Journal of Impotence Research* 2007; 19: 321–25.

18. Whelan-Goodinson R, Ponsford J. Validity of the Hospital Anxiety and Depression Scale to assess depression and anxiety following traumatic brain injury as compared with the Structured Clinical Interview for DSM-IV. *Journal of Affective Disorders* 2009; 114: 94-102.

19. American Diabetes Association. Standards of medical care in diabetes. *Diabetes Care* 2006; 29:4–42.

20. Vaz NC, Ferreira AM, Kulkarni MS, et al. Prevalence of diabetic complications in rural Goa, India. *Indian J Community Med* 2011; 36: 283–6.

21. Mooradian AD. Dyslipidemia in type 2 diabetes mellitus. *Nature Clinical Practice: Endocrinology & Metabolism* 2009; 5: 150-9.

Formatted: Font: (Default) Times New Roman, 12 pt, Italic

22. Morley JE. The elderly type 2 diabetic patient: special considerations. Diabetic Medicine 1998; 15: 41-6.

23. Almawi W, Tamim H, Al-Sayed N, *et al.* Association of comorbid depression, anxiety, and stress disorders with Type 2 diabetes in Bahrain, a country with a very high prevalence of type 2 diabetes. *Journal of Endocrinological Investigation* 2008; 31: 1020–24.

24. Ganatra HA, Zafar SN, Qidwai W, *et al.* Prevalence and predictors of depression among an elderly population of Pakistan. *Aging Ment Health* 2008; 12:349-56.

25. Mosaku K, Kolawole B, Mume C, *et al.* Depression, anxiety and quality of life among diabetic patients: a comparative study. *Journal of the National Medical Association* 2008; 100: 73–8.

26. Dunlop DD, Song J, Lyons JS, *et al.* Racial or ethnic differences in rates of depression among preretirement adults. *Am J Public Health* 2003; 93:1945–952.

27. Fisher L, Laurencin G, Chesla CA, *et al.* Depressive affect among four ethnic groups of male patients with type 2 diabetes. *Diabetes Spectr* 2004; 17:215–19.

28. Thomas J, Jones G, Scarinci I, *et al.* A descriptive and comparative study of the prevalence of depressive and anxiety disorders in low-income adults with type 2 diabetes and other chronic illnesses. *Diabetes Care* 2003; 26:2311–17.

29. Bener A, Al-Hamaq AO, Dafeeah EE. High prevalence of depression, anxiety and stress symptoms among diabetes mellitus patients. *The Open Psychiatry Journal* 2011; 5: 5-12.

Table 1: Socio-demographic characteristics of the respondents (n=169)

Characteristics	N	Percentage (%)
Gender		
Male	99	58.6
Female	70	41.4
Age (years)		
< 50	137	81.1
≥ 50	32	18.9
Ethnicity		
Malay	53	31.3
Chinese	88	52.1
Indian	28	16.6
Marital status		
Single	63	37.3
Married	106	62.7
Highest education level		
High school	75	44.4
Tertiary education	94	55.6
Residence		
Urban	132	78.1
Rural	37	21.9
Monthly household income (MYR)		
< 3000	56	33.1
≥ 3000	113	66.9
Current employment status		
Employed	119	70.4
Unemployed	50	29.6

* 1MYR is equivalent to 0.33USD at the time of study

Formatted: Font: (Default) Times New Roman, 12 pt

Formatted: Font: (Default) Times New Roman, 12 pt

Table 2: Clinical health information of the respondents (n=169)

Characteristics	N	Percentage (%)
Diabetes vascular complications		
Cerebrovascular accident (CVA)		
Yes	12	7.1
No	157	92.9
Ischemic heart disease (IHD)		
Yes	24	14.2
No	145	85.8
Diabetic nephropathy		
Yes	17	10.1
No	152	89.9
Co-morbidities		
Diabetes alone	104	61.6
Diabetes with hypertension or dyslipidemia	44	26.0
Diabetes with hypertension and dyslipidemia	21	12.4
Anxiety		
Normal	116	68.6
Mild	33	19.5
Moderate	16	9.5
Severe	4	2.4
Depression		
Normal	101	59.7
Mild	49	29.0
Moderate	16	9.5
Severe	3	1.8

Table 3: Association between anxiety and depression with socio-demographic characteristics of the respondents (n=169)

Characteristics	Anxiety		Depression	
	Mean (SD)	P-value	Mean (SD)	P-value
Gender				
Male	7.0 (3.5)		7.1 (3.5)	
Female	6.8 (3.0)	0.737	6.6 (3.1)	0.345
Age (years)				
< 50	6.4 (2.7)		6.3 (2.9)	
≥ 50	9.1 (4.6)	< 0.001	9.2 (4.0)	<0.001
Ethnicity				
Malay	6.5 (3.8)		6.9 (3.1)	
Chinese	6.6 (2.4)		5.9 (2.9)	
Indian	8.4 (4.2)	0.035	9.8 (3.5)	< 0.001
Marital status				
Single	6.7 (2.7)		6.9 (2.9)	
Married	7.0 (3.6)	0.601	6.8 (3.6)	0.894
Highest education level				
High school	7.5 (4.0)		7.7 (3.7)	
Tertiary education	6.4 (2.5)	0.037	6.2 (2.9)	0.006
Residence				
Urban	6.8 (2.9)		6.7 (3.1)	
Rural	7.2 (4.5)	0.569	7.6 (3.9)	0.125
Monthly household income (MYR)				
< 3000	7.5 (4.4)		8.7 (3.6)	
≥ 3000	6.6 (2.6)	0.090	6.0 (2.8)	<0.001
Current employment status				
Employed	6.6 (3.2)		6.4 (3.3)	
Unemployed	7.6 (3.4)	0.078	7.9 (3.2)	0.007

Table 4: Association between anxiety and depression with clinical health information of the respondents (n=169)

Characteristics	Anxiety		Depression	
	Mean (SD)	P-value	Mean (SD)	P-value
Diabetes vascular complications				
Cerebrovascular accident (CVA)				
Yes	6.6 (4.1)		6.7 (4.8)	
No	6.9 (3.3)	0.742	6.9 (3.2)	0.823
Ischemic heart disease (IHD)				
Yes	8.7 (4.2)		7.8 (4.1)	
No	6.6 (3.1)	0.004	6.7 (3.2)	0.131
Diabetic nephropathy				
Yes	7.4 (2.2)		6.4 (3.0)	
No	6.8 (3.4)	0.492	6.9 (3.4)	0.548
Co-morbidities				
Diabetes alone	6.6 (3.3)		6.3 (3.4)	
Diabetes with hypertension or dyslipidemia	7.2 (3.4)		7.5 (3.2)	
Diabetes with hypertension and dyslipidemia	7.7 (3.0)	0.289	8.4 (2.9)	0.010

Table 5: ~~Predictors~~ Factors associated with ~~of~~ anxiety among ~~diabetic~~patients with diabetes by multiple linear regression (n=169)

Predictors	B	SE	Beta	P-value	95% CI	
					Lower	Upper
Age (Years)						
< 50	Ref	Ref	Ref	Ref	Ref	Ref
≥ 50	2.3	0.7	0.3	0.001	0.9	3.6
Ethnicity						
Malay	Ref	Ref	Ref	Ref	Ref	Ref
Chinese	0.7	0.6	0.1	0.194	-0.4	1.8
Indian	1.7	0.7	0.2	0.018	0.3	3.2
Highest education level						
High school	0.1	0.5	0.0	0.871	-1.0	1.1
Tertiary educated	Ref	Ref	Ref	Ref	Ref	Ref
Having ischemic heart disease (IHD)						
Yes	1.5	0.7	0.2	0.039	0.1	2.9
No	Ref	Ref	Ref	Ref	Ref	Ref

Table 6: Factors associated with ~~Predictors of~~ depression among ~~diabetics~~patients with diabetes by multiple linear regression (n=169)

Predictors	B	SE	Beta	P-value	95% CI	
					Lower	Upper
Age (Years)						
< 50	Ref	Ref	Ref	Ref	Ref	Ref
≥ 50	1.4	0.6	0.2	0.027	0.2	2.7
Ethnicity						
Malay	0.4	0.5	0.1	0.458	-0.7	1.4
Indian	2.7	0.7	0.3	<0.001	1.4	4.0
Chinese	Ref	Ref	Ref	Ref	Ref	Ref
Highest education level						
High school	-0.3	0.5	-0.1	0.548	-1.4	0.7
Tertiary educated	Ref	Ref	Ref	Ref	Ref	Ref
Monthly household income (MYR)						
< 3000	1.9	0.6	0.3	0.001	0.8	3.0
≥ 3000	Ref	Ref	Ref	Ref	Ref	Ref
Current employment status						
Employed	Ref	Ref	Ref	Ref	Ref	Ref
Unemployed	-1.7	1.5	-0.2	0.265	-4.7	1.3
Co-morbidities						
Diabetes alone	Ref	Ref	Ref	Ref	Ref	Ref
Diabetes with hypertension or dyslipidemia	-2.6	1.5	-0.4	0.080	-5.5	0.3
Diabetes with hypertension and dyslipidemia	-2.3	1.7	-0.2	0.189	-5.7	1.1

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6,7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6,7
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	8
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	-
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	8
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	-
Outcome data	15*	Report numbers of outcome events or summary measures	8,9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-11
		(*b*) Report category boundaries when continuous variables were categorized	9-11
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.